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THE CLOGGING OF DRAIN TILE BY ROOTS

By G. E. Stone

Quite frequently trouble is experienced from roots of various trees entering drain tile, sewers, etc., and this often causes much vexation, labor and expense. The Carolina poplar, which is often planted as a shade tree in cities, frequently becomes a nuisance in consequence of its peculiar habit of working its roots through the joints of tile used for sewerage, etc. It is a comparatively easy matter for roots to gain entrance into the uncemented joints of tile, and even when tile is cemented they often manage to crowd in and fill the tile with a mass of roots which eventually clog the tile and render it useless. Instances are even known of roots penetrating sewers constructed of brick and cement. The roots of other trees besides Carolina poplars are known to be offenders in this respect. Willows, elms and others are responsible for considerable clogging of tile, and grass roots will in a comparatively short time put out of commission the most effective drain. There are also many instances of even fungi and algae clogging up small drains. The writer some years ago had called to his attention a case of *Oscillatoria* constantly clogging tile, much to the annoyance of the landowner; and, is also familiar with a case where the drain tile underlying the steam conduit of a central heating and distributing plant was continually being clogged by root growth. The joints of the six-inch Akron tile underlying the steam heating pipes were not cemented and were four or five feet below the surface. In two or three years after the tile were laid some of them had become clogged with elm tree roots. This clogging prevented the water from flowing through the tile and caused a dam, as it were, resulting in the water flowing back into the conduit and flooding

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the steam pipes which greatly interfered with their efficiency. It is necessary, of course, to leave the joints of Akron tile open when used for the purpose of draining the conduit trench since these pipes must take off the water from the trench and prevent it from coming into contact with the steam pipes in the conduit. As long as the joints remain open it is with great difficulty that the roots of trees, etc., are kept from growing in the tile, and sooner or later it is made ineffective.

Tree roots will penetrate tile protected with carefully cemented joints and become a nuisance, as is shown by the following instance. In the city of Newark, N. J., the Shade Tree Commission have been requested by the Department of Sewers and Drainage to omit the planting of Carolina poplars on streets since the roots of these trees proved to be a nuisance to drains. Mr. Edward S. Rankin,* Engineer of Sewers and Drainage of the city of Newark, writes as follows:

"Replying to your letter of the twentieth inst., we find that the roots go through the joints of tile pipe even when carefully cemented and the trouble seems to be increasing. In 1909 we had 15 stoppages caused by roots; for the first 11 months of 1910, 23, of which 5 occurred in the month of November. These stoppages were all in house connections, and in addition to these we have also had a number of cases in our main pipe sewers. The roots after penetrating the pipe seem to spread out and practically fill the whole pipe. I have no way of knowing how long a time it takes for these roots to grow. To the best of my knowledge we have had no trouble with any of our brick sewers. The trouble seems to have been caused in all cases by poplar trees."

There recently came to our attention a notable case of a large drain tile being clogged by the roots of a pear tree. This tile was 12 inches in diameter and was laid about seven years ago to take the seepage waters from a reservoir located in the town of Belmont, Mass. The pipe passed near a pear orchard, and there was a constant flow of water through it summer and winter, although it was never full. At the time the tile was laid the joints were not cemented, and of course there was an opportunity

*See also Municipal Journal and Engineer, vol. 30, no. 1, January 4, 1911.

for roots of various kinds, if so disposed, to penetrate the joints of the pipe and secure an abundant supply of water. During November, 1909, about seven years after the drain pipe was installed, it became necessary to dig up a large part of it on account of its inefficiency and replace it. It was found on digging up this tile that it was badly congested by a profuse root growth. A careful examination of the location showed that this growth

FIG. 1.—Showing pear tree root taken from drain tile.

of roots originated from a single off-shoot of a pear tree located some seven feet away. This enormous mass of pear roots was removed from the tile and carefully laid aside and at our request was presented to our museum, with full data concerning it. The roots were found to measure 61 feet in length. Only a single root entered the tile, it having a diameter of about five-eighths of an inch inside the tile, but where it entered the tile it was somewhat flattened out. The root, on entering the tile, subdivided into innumerable rootlets, and these were again divided into countless smaller roots. At the time the tile was dug up and the roots removed the drain had been in operation seven years, although a cross-section of the root and an examination of the annular rings where it entered the tile, showed that it was only five years old. It required, therefore, only five years for this mass of roots to clog up a 12-inch tile.

The maximum diameter of this mass of roots in the dry state is six or seven inches, but when alive and flourishing in the tile its diameter exceeded this. The roots as they reached the laboratory had a decidedly bad odor, showing that if no sewage was present in the tile there was certainly a considerable amount of organic matter in the seepage derived from the soil or some other source which proved of value as plant food. Soon after the specimens arrived at this laboratory they were spread out on the floor and measured. This was done by laying out on the floor sections five feet in length. The number of roots in each five-foot section was counted. These were multiplied by the length of the section and the whole tabulated (see table). The total length of these roots was 8,498 feet, as shown in the table, which is equal to 1.61 miles. Adding to this the numerous small roots which range from a few to several inches in length and which were not considered in our section count, the total length was estimated to be over two miles.

This enormous development from a single root of a pear tree is greatly in excess of what would take place if the roots were

TABLE SHOWING THE GROWTH OF PEAR TREE ROOTS IN DRAIN TILE

No. of Section.	Length of Section.	No. of Roots in Section.	Length of Roots in Section.
1	5 ft.	34	170 ft.
2	5	41	205
3	5	73	365
4	5	153	765
5	5	199	995
6	5	313	1565
7	5	373	1865
8	5	447	2235
9	5	141	705
10	5	53	265
11	5	31	155
12	5	36	180
13	1	28	28
Total	61	1922	8498

in the soil, since the conditions of the drain tile stimulate root development very materially. However, the root system of any tree or shrub is far in excess in length and area of what the layman imagines. The profuse growth of roots in water is also seen in cases where old wells become filled with root growth, but the pear tree root in question is one of the best examples which has ever come to our notice of root development in drain tile.

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THE NATURE AND FUNCTION OF THE PLANT OXIDASES

By Ernest D. Clark]

(Continued from February Torreya)

Peroxidase

Besides the laccase and tyrosinase which we have been considering, there are other oxidizing enzymes which are not specific like the two mentioned. They act only in the presence of hydrogen peroxide, and therefore are called peroxidases. These enzymes have also been called "indirect oxidases" in distinction from those substances (Bach's oxygenases) which show their activity without the addition of peroxide as in the case of tyrosinase, etc. In 1903, Bach and Chodat[15] discovered that by fractional precipitation of aqueous extracts of *Lactarius vellereus*, they were able to obtain two precipitates of very different properties. The fraction insoluble in 40 per cent. alcohol proved to be a direct oxidase, while the other fraction, soluble in 40 per cent. alcohol, but insoluble in 95 per cent. alcohol, had no direct oxidizing properties. With hydrogen peroxide and other peroxides, however, the second fraction showed strikingly peroxidase properties. Moreover, the peroxidase fraction, when allowed to act with the direct oxidase fraction, showed all the properties of

[15] Bach and Chodat. Title of series is: Untersuchungen über die Rolle der Peroxyde in der Chemie der lebenden Zellen; V. Zerlegung der sogenannte Oxydasen in Oxygenasen und Peroxydasen. Ber. Chem. Gesell. 36: 606. 1903.